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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/536,463	03/13/2006	Rama Venkatasubramanian	9510-11	5162

20792 7590 12/29/2009

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EXAMINER	
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ART UNIT	PAPER NUMBER
1795	

MAIL DATE	DELIVERY MODE
12/29/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/536,463	VENKATASUBRAMANIAN ET AL.	
	Examiner	Art Unit	
	GOLAM MOWLA	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09/14/2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-55* is/are pending in the application.

4a) Of the above claim(s) *3 and 32-55* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05/25/2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *05/25/2005 and 09/14/2009*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Claims 3 and 32-55 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species and invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 09/14/2009.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the controller (as claimed in claim 19) and split header (as claimed in claim 22) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 112

3. Claim 21 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 21 recites the limitation "said temperature differential" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-2, 11-15 and 22 are rejected under 35 U.S.C. 102(b) as being anticipated by Venkatasubramanian (US 6,300,150 B1).

Regarding claim 1, Venkatasubramanian discloses a thermoelectric device (see figs. 6 and 9) comprising: at least one unipolar couple element having two legs of a same electrical conductivity type (two P-type semiconductor legs as shown in fig. 9; see fig. 1 as illustrated below); a first-temperature stage connected to one of said two legs; a second-temperature stage connected across said legs of the at least one unipolar

couple element; and a third-temperature stage connected to the other of said two legs (see 2:55-5:32) (see fig. 1 below).

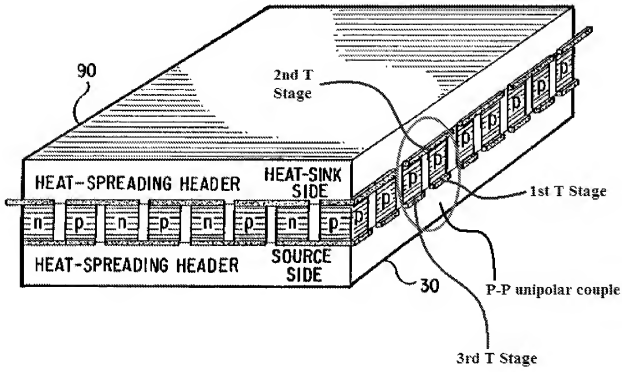

Figure 1: Thermoelectric device of Venkatasubramanian using unipolar couple elements

Regarding claim 2, Venkatasubramanian further discloses the thermoelectric devices allows for high cooling (col. 1, lines 40-43), and therefore the TE device must inherently functions in Peltier mode. It is well known in the thermoelectric art that in Peltier mode operation, the thermoelectric elements are configured such that currents flow in opposite directions in the two legs of the at least one unipolar couple element to establish a temperature differential across each of the two legs of said unipolar couple element.

Regarding claims 11-15, the reference further discloses at least one set of P-P unipolar bulk couple (see fig. 1 as shown above), one set of n-n unipolar bulk couple (see figs 6 and 7 which shows n-n unipolar couple on the left side of the TE device), and two independent legs of p or n).

Regarding claim 22, the reference further discloses that the first and second temperature stages are in split stages (see fig. above).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.,* 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 4-7, 16, 21, 26 and 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian as applied to claim 1 above, and further in view of Ghoshal (US 2002/0092557 A1).

Regarding claim 4, Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The

reference further discloses that the unipolar couple element comprises superlattice (2:67-3:6). However, the reference is silent as to p-type Bi_2Te_3/Sb_2Te_3 superlattice thermoelements.

Ghoshal discloses a thermoelectric cooler wherein the p-type semiconductor comprises Bi_2Te_3/Sb_2Te_3 superlattice thermoelements (see ([0039] and [0066]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the Bi_2Te_3/Sb_2Te_3 superlattice thermoelements of Ghoshal in the thermoelectric device of Venkatasubramanian, because doing so only predictable results of thermoelectric cooling would have been achieved, as taught by Ghoshal ([0075]) and also desired by Venkatasubramanian (col. 1, lines 40-43).

Regarding claim 5, Venkatasubramanian in view of Ghoshal discloses the pair of p-type Bi_2Te_3/Sb_2Te_3 superlattice thermoelements as in the case of instant application. Therefore, the p-type Bi_2Te_3/Sb_2Te_3 superlattice thermoelements must inherently have a ZT of >1 at 300K. If different results are achieved, it must be due to the limitations that are not currently claimed.

Regarding claim 6, Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The reference further discloses that the unipolar couple element comprises superlattice (2:67-3:6). However, the reference is silent as to n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements.

Ghoshal discloses a thermoelectric cooler wherein the n-type semiconductor comprises $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements (see ([0039] and [0066]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements of Ghoshal in the thermoelectric device of Venkatasubramanian, because doing so only predictable results of thermoelectric cooling would have been achieved, as taught by Ghoshal ([0075]) and also desired by Venkatasubramanian (col. 1, lines 40-43).

Regarding claim 7, Venkatasubramanian in view of Ghoshal discloses the pair of n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements as in the case of instant application. Therefore, the n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements must inherently have a ZT of >1 at 300K. If different results are achieved, it must be due to the limitations that are not currently claimed.

Regarding claim 16, Venkatasubramanian in view of Ghoshal discloses the pair of p-type Bi_2Te_3/Sb_2Te_3 superlattice thermoelements and the pair of n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements as in the case of instant application. Therefore, the unipolar couple elements must inherently produce temperature differentials in a range from 1K to 200K. If different results are achieved, it must be due to the limitations that are not currently claimed.

Regarding claim 21, Venkatasubramanian in view of Ghoshal discloses the pair of p-type Bi_2Te_3/Sb_2Te_3 superlattice thermoelements and the pair of n-type $Bi_2Te_3/Bi_2Te_{3-x}Se_x$ superlattice thermoelements as in the case of instant application. Therefore, the temperature differential across each leg of said two legs must inherently be about half a temperature differential between the first-temperature stage and the

second-temperature stage. If different results are achieved, it must be due to the limitations that are not currently claimed.

Regarding claim 26, Venkatasubramanian in view of Ghoshal discloses that each of the legs of the p-p couple comprises different material composition and a different structure from the other leg (see [0039] of Ghoshal).

Regarding claim 28, Venkatasubramanian in view of Ghoshal discloses the p-type legs comprise Bi_2Te_3/Sb_2Te_3. Although the reference is silent as to the claimed dimension, Examiner notes that the selection of element dimensions is considered to be a matter of design choice, depending upon the dimensions and gradient present in the installation site, substrate dimensions, desired number of junctions, desired voltage, among other considerations. In the absence of evidence of criticality, selection of claimed dimension is considered obvious to one having ordinary skill in the art. Also note that in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that, where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Regarding claim 29, Venkatasubramanian in view of Ghoshal discloses that each of the legs of the n-n couple comprises different material composition and a different structure from the other leg (see [0039] and [0066] of Ghoshal).

9. Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian as applied to claim 1 above, and further in view of Harman (US 5,415,699).

Regarding claims 8 and 10, Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The reference further discloses that the unipolar couple element comprises superlattice (2:67-3:6). However, the reference is silent as to n-type or p-type pair comprises PbTeSe/PbTe superlattice thermoelements.

Harman discloses a thermoelectric cooler (8:13-46) wherein the n-type or p-type semiconductor comprises PbTeSe superlattice thermoelement (5:62-6:9).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the PbTeSe/PbTe superlattice thermoelements of Ghoshal in the thermoelectric device of Venkatasubramanian, because doing so only predictable results of thermoelectric cooling would have been achieved, as taught by Harman (8:13-46) and also desired by Venkatasubramanian (col. 1, lines 40-43).

Regarding claim 9, Venkatasubramanian in view of Ghoshal discloses the pair of n-type PbTeSe/PbTe superlattice thermoelements as in the case of instant application. Therefore, the n-type PbTeSe/PbTe $_3$ superlattice thermoelements must inherently have a ZT of ~ 1.6 at 300K. If different results are achieved, it must be due to the limitations that are not currently claimed.

10. Claims 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian as applied to claim 1 above, and further in view of Adelman (US 5,837,929)

Regarding claims 17-18, Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The reference is silent as to a thermal insulation between the first and third temperature stages.

Adelman discloses a thermoelectric cooler (2:17-21) wherein a thermal insulation (15) of a polymer sheets (polyimide) (3:50-54) is provided between the temperature stages (16s) (see fig. 3) in order to provide heat insulation between the thermoelements (4:17-18).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the thermal insulation layer of Adelman in the thermoelectric device of Venkatasubramanian in order to provide heat insulation between the thermoelements as shown by Adelman.

11. Claims 19-20 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian as applied to claim 1 above, and further in view of Chang et al. (US 2003/0209014 A1).

Regarding claim 19-20, Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The reference is silent as a controller configured to control a temperature of the second-

temperature stage by flow of current to produce desired source and drain temperatures on the first-temperature stage and the third-temperature stage, respectively.

Chang discloses the use of a CPU controller (56) (fig. 9) in a thermoelectric cooler (60) in order to control the current that flows through the thermoelectric device (10) ([0047]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the CPU controller of Chang in the thermoelectric device of Venkatasubramanian in order to control the current that flows through the thermoelectric device as taught by Chang. Examiners note that the flow of current inherently produces desired source and drain temperatures as in the case of instant application. If different results are achieved, it must be due to the limitations that are not currently claimed.

Regarding claims 23-24, Examiner notes that there is no structural difference between the thermoelectric device of Venkatasubramanian and the instant claimed thermoelectric device. In addition, Venkatasubramanian in view of Chang further discloses the use of controller to flow current in order to the temperature of the temperature stages to desired temperature. Therefore, the thermoelectric device of Venkatasubramanian in view of Chang must inherently be configured to operate at a temperature about 100 C so that a phase change of water to steam provides heat removal and said first-temperature stage is configured to operate at a temperature below 10 C or below.

12. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian as applied to claim 1 above, and further in view of Hed (US 5,228,923).

Applicant is directed above for complete discussion of Venkatasubramanian with respect to claim 1, which is incorporated herein. The reference is silent as to a water-based closed cycle heat removal system connected to the third-temperature stage.

Hed discloses a thermoelectric device which can be used for cooling (14:10-16) and further discloses a water-based closed cycle heat removal system (see fig. 3) (10:39-57).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the water-based closed cycle heat removal system of Hed in the thermoelectric device of Venkatasubramanian, because doing so only predictable results of thermoelectric cooling would have achieved, as shown by Hed and also desired by Venkatasubramanian.

13. Claims 27 and 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Venkatasubramanian in view of Ghoshal (US 2002/0092557 A1) as applied to claim 29 above, and further in view of Ladd et al. (US 6,100,463).

Regarding claims 27 and 30, Venkatasubramanian in view of Ghoshal discloses that each of the legs of the p-p or n-n couple comprises different material composition and a different structure from the other leg (see [0039] and [0066] of Ghoshal). Although the references teach the use of bismuth telluride as the p-type or n-type legs, the references are silent as to whether the p-type legs are comprised of $Bi_{1.0}Sb_{1.0}Te_3$

and $Bi_{0.5}Sb_{1.5}Te_3$, and whether the n-type legs are comprised of $Bi_2Te_{2.5}Se_{0.5}$ and $Bi_2Te_{2.85}Se_{0.15}$.

Ladd teaches a thermoelectric device (see figures) wherein bismuth telluride is used as the p-type or n-type legs (5:47-50) wherein the antimony (Sb) and selenium (Se) are utilized as p-type and n-type dopants, respectively, in order determine the conductivity of the thermoelements.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the Sb and Se dopants of Ladd in the thermoelectric device of Venkatasubramanian in view of Ghoshal in order to determine the conductivity of the thermoelements. Although Venkatasubramanian in view of Ghoshal and Ladd are silent as to the specific composition of the thermoelements, one skilled in the art can perform routine experimentation to determined the optimum amount of Sb and Se needed, since it has been held that discovering an optimum value for a result of effect variable involves only routine skill in the art (MPEP §2144.05 (II b)).

Regarding claim 31, Examiner notes that the selection of element dimensions is considered to be a matter of design choice, depending upon the dimensions and gradient present in the installation site, substrate dimensions, desired number of junctions, desired voltage, among other considerations. In the absence of evidence of criticality, selection of claimed dimension is considered obvious to one having ordinary skill in the art. Also note that in *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that, where the only difference between the prior art and the claims

was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-F, 0900-1700 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, JENNIFER KOLB-MICHENER can be reached on (571) 272-1424 until Dec 31, 2009, or ALEXA NECKEL can be reached on (571) 272-1446 from January 2009, onwards. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/G. M./
Examiner, Art Unit 1795
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